REMARKS

Claims 1-2 and 8-12 stand rejected under 35 USC §102(e) as being anticipated by Nagata et al., U.S. patent 6,496,018 or Tews et al., U.S. patent 5,397,993. Claims 1-2 and 8-12 stand rejected under 35 USC §102(e) as being anticipated by Scott U.S. Patent publication 2002/0005725. Claims 3-5 stand rejected under 35 USC §103(a) as being unpatentable over Scott in view of Lautenschlager et al., U.S. patent 5,382,414. Claims 6-7 stand rejected under 35 USC §103(a) as being unpatentable over Scott in view of Madaras et al., U.S. Patent publication 2003/0012867.

Claims 2, 8, 9, and 12 have been amended to more clearly state the invention. No new matter is added by the present amendment, and entry of the present amendment is respectfully requested. Reconsideration and allowance of each of the pending claims 2-12, as amended, is respectfully requested.

As amended, independent claim 2 is believed to distinguish over all of the references of record. Independent claim 2 has been amended to more clearly state the invention and in an earnest attempt to place the present application in condition for allowance and allowance of the present application is respectfully requested.

Nagata et al., U.S. patent 6,496,018 discloses that the sample measuring face of a dielectric resonator (20) is placed near a standard sample having a known dielectric constant at a fixed interval D. While appropriately varying the dielectric constant and thickness of the standard sample under the above condition, the variation of the resonance frequency of the dielectric resonator (20) is measured for each varied

dielectric constant and thickness to draw a calibration curve of the varied resonance frequency depending on the dielectric constant and thickness. Under the same condition where calibration curve is drawn, the variation of the resonance frequency of the dielectric resonator (20) for a sample having a known thickness is measured. The dielectric constant of the sample is found from the measurement value and the calibration curve. The dielectric constant of not only a sheetlike sample but also a three-dimensional molded article or a liquid sample can be measured easily.

Tews et al., U.S. patent 5,397,993 discloses a process and a device for determining the moisture content of the material of a test object using microwaves. The properties of a resonator such as resonance frequency, resonance half-width value and amplitude of the resonance can be measured using a digitally tunable quartz-stable PLL-controlled microwave generator. By special processing of the variations in the results due to detuning of the resonator when it is being filled with a product, the moisture content of the material in the product can be measured exactly, independently of the density of the material and largely independently of the type of material and of changes in additives. The same measurement equipment can be used, without any rearrangement of the hardware, both in the ppm range and up to moisture contents greater than 80%. In addition, there are no special requirements concerning the shape of the sample.

Scott U.S. Patent publication 2002/0005725 discloses systems, methods, and probe devices for electronic monitoring and characterization using single-ended coupling of a load-pulled oscillator to a system under test. Specific embodiments

include a coaxial transmission line whose outer layer is a metallic mesh enclosing an adsorbent media which is specific to the material to be detected. As set forth in Scott:

[0047] This provides a means for determination of the range of dielectric constant change in a medium even when it rotates the phase vector multiple times (and therefore, the oscillator frequency returns to the same value multiple times). If the dielectric constant of the material in the transmission line is increased, then the above equations show that the frequency of the first full wavelength is decreased by the square root of the dielectric constant. Additionally, this means that the number of wavelengths at a fixed frequency increases with increasing dielectric constant. These facts imply that the VCO tuning curve will see more "hops" as the dielectric constant is increased due to the increasing fraction or whole wavelengths encountered.

[0063] Various types of apparatus have been proposed for measuring the concentration of one substance in another, particularly the concentration of a liquid or flowable substance in another liquid or flowable substance. Various devices which utilize the broad concept of determining composition of matter by measuring changes in a microwave signal are disclosed in U.S. Pat. Nos. 3,498,112 to Howard; 3,693,079 to Walker; 4,206,399 to Fitzky et al.; 4,311,957 to Hewitt et al.; 4,361,801 to Meyer et al.; 4,240,028 to Davis Jr.; 4,352,288 to Paap et al.; 4,499,418 to Helms et al.; and 4,367,440 and 4,429,273, both to Mazzagatti; all of which are hereby incorporated by reference.

[0066] At higher frequencies (above approximately 100 MHz), the capacitive measurement technique fails to work, due to line lengths and stray capacitances. At such frequencies resonant cavity techniques have been employed. (For example, a sample is placed in a resonant cavity to measure the loss and frequency shift with a external microwave frequency source that can be swept across the resonance with and without the sample in the cavity.) This method uses a highly isolated microwave frequency source which is forced by the user (rather than being pulled by the changing resonance) to change its frequency. This technique too meets substantial difficulties. For example, the use of multiple interfaces without a microwave impedance match at each interface causes extraneous reflections, which tend to hide the desired measurement data. This technique too gives errors with very lossy material, but in this case it is due to the very rounded nature of the resonance curve (which is due to the low Q of the loaded cavity). This rounded curve makes it difficult to determine both the center frequency and the 3 dB rolloff frequency closely enough to be accurate in the measurement.

[0210] If fluids with well known .epsilon.'s are placed in this test section and frequency and incident and reflected plowers noted, a calibration curve should be generated which can be related to various VCO/pipe configurations. The pipe section used was a version of the 0.5" 5" long unit with 1/8 rod. The taper was across approximately 3" with the center rod protruding .apprxeq.1" past the end of the taper.

[0218] A particular advantage of the absorber-coated probe is that it can be designed to be self-calibrating. By contrast, other probes may need to be calibrated

with a sample which is (or approximates) the material in question.

Lautenschlager et al., U.S. patent 5,382,414 discloses apparatus for performing chemical and physical pressure reactions on samples by the action of microwaves, having container inserts to receive the samples that are at least in part microwave-permeable and are arranged in a microwave-impermeable housing connected via at least one coupling opening to a microwave generator. To enable pressure reactions to be performed at higher pressures and more economically overall, it is proposed according to the invention that the housing include at least one pressure vessel (4) of high-pressure resistant material whose coupling opening (12) is microwave-permeable and closed in a high-pressure resistant manner, and that a single container insert is arranged in the pressure vessel (4) so as to fit closely against its inner surface.

Madaras et al., U.S. Patent publication 2003/0012867 discloses a resonant cavity frequency sensing device is used to sense the moisture content of a substrate. Data obtained by the sensing device can be used in a feedback loop in the apparatus employing the device, to help control the operation of the apparatus in order to obtain consistent results. The sensor may employ one pair of sensing plates or an array of pairs of sensing plates to obtain data from each part of the substrate. In an illustrated embodiment, the device is used to monitor and control dip uptake in a fabric adhesive dipping process. Madaras et al. states: [0051] Sensor plates 48 comprise a portion of a high-frequency resonant cavity measurement device similar to those used in the paper industry to monitor paper. In the illustrated embodiment, the two parallel

plates, which are the resonator or sensor plates, are located on each side of the fabric web as it exits the adhesive dip bath and dewebber heads. By generating a high frequency field between the parallel plates, the resonant frequency for the empty space between the plates is determined. In the illustrated embodiment, the 350 megahertz level was used because it produced the optimal frequency for lowest cost hardware selection. Other frequencies can be used to optimize each application. The frequency changes or shifts when something passes between the plates, and it has been found according to the present invention that the amount of shift can also be correlated to the amount of dip (liquid rubber or adhesive solution) that has been retained on the fabric. Using this correlation, the amount of adhesive applied to the fabric can be measured and controlled during the application process so that all areas of the fabric can be monitored as it is dipped, reducing the need for human inspection. Accurately controlling the adhesive application on the fabric may provide a more uniform dip and better control of adhesive consumption.

Conventionally there exists no fast identification or screening method especially for detection of biological agents and toxins that may be in powder form in mail packages or in aerosol form dispersed over a wide area. Our method offers a fast identification, substantially near real time, of biological materials based on their dielectric response in a resonant structure. The present invention has shown for the first time that dielectric signatures of biological and chemical molecules offer a modicum of selectivity based on which a "detect to warn sensor" for any biological or chemical attack is offered.

Nagata et al. (US 6496018), Tews et al. (US 5397993), and Scott (US 20020005725) offer a respective method of detecting solid or liquid materials based on frequency shifts in a resonant cavity or a quarter-wave transmission line. Although the respective disclosed methods may measure the concentration of a given material in a process based on the frequency shift, effectively differentiate between materials is not possible. Any dielectric material will cause frequency shift. In other words, the respective disclosed methods cannot discriminate anthrax from proteins. Instead, what the present invention offers is an identification method based on a material's response in a 2-dimensional feature space consisting of shift in resonance frequency and change in line width or the quality factor. These two features are intrinsic to the material dielectric property and form the principal components of a two-variable classification method that we have used for detection. In the two-dimensional space, the dielectric responses of materials separate into different patterns, enabling identification. More importantly, the present inventors have shown by measurements that the signature patterns are distinct and repeatable for biological and chemical molecules. In other words, there is no prior art that point to measuring the "fingerprint" of biological agents using their dielectric property.

The present invention teaches and claims a dielectric sensing method for detection and classification of chemical and biological materials. Applicants acknowledge that there are many methods for measuring the dielectric properties of materials, such as lumped element, transmission line, free-space, and resonate techniques. These techniques, depending on sample size and geometry can provide

accurate determination of complex dielectric constants of materials in a laboratory setting. However, though many methods of measuring the dielectric properties of materials exist in the literature, such methods lack specificity in identifying materials.

Applicants use of dielectric resonance pattern shifts and signal processing to devise a method of detection and classification for chemical and biological species, in all forms of matter-- gas, liquid, aerosol, and solids is not shown, nor suggested in the prior art. Only Applicants teach selectively generating said resonance patterns either as a function of sample concentration or as a function of excitation frequency for a given sample; and using said generated resonance patterns for real-time identifying chemical and biological materials of the sample. Compared to conventional dielectric methods that lack selectivity to identify materials, the new technique of the invention offers a modicum of selectivity at any resonance frequency suitable for the sample under test. If the resonance frequency, however, is selected to match the dielectric relaxation or spectroscopic resonance of the sample material, the selectivity can be significantly improved. The resonance technique, because of its high quality factor, offers higher detection sensitivities than non-resonant techniques. Applicants derive spectroscopic information of chemical and biological materials for enhancing sensitivity and selectivity of detection solids is not shown, nor suggested in the prior art.

Additionally, the method of the invention as recited in independent claim 2, as amended, is applicable to all frequencies from RF to microwave to terahertz (THz). The type of resonator depends on the frequency range: a quarter-wave transmission line in the RF, cylindrical cavity in the microwave, a Fabry-Perot cavity in

the THz. The higher the frequency, more sensitive is the detection because of inherently higher quality factors of the resonators at higher frequencies. Also, the phonon mode resonances of crystalline materials that occur at terahertz frequencies can be identified with this method in the form of resonance spikes in the dielectric response pattern. Overall, the method of the invention is more versatile, applicable in solid, liquid or gaseous forms of chemical or biological agents and can use any resonant structure in the RF, microwave, or THz frequencies, more specific and selective to materials from the identification standpoint, and addresses a key homeland security problem enabling a "detect to warn" sensor.

Applicants respectfully submit that there are significant differences between what is disclosed in each of the Nagata et al., Tews et al. patents and the Scott publication, and the subject matter of the pending claims 2-12,as amended, and respectfully requests withdrawal of the rejection under 35 U.S.C. §102 because "[i]t is axiomatic that for prior art to anticipate under §102 it has to meet every element of the claimed invention" (<u>Hybritech Inc. v. Monoclonal Antibodies, Inc.</u>, 802 F.2d 1367, 1379, 231 USPQ 81, 90 (Fed. Cir. 1986)). <u>See</u> also <u>In re Bond</u>, 910 F.2d 831, 832, 15 USPQ2d 1566, 1567 (Fed. Cir. 1990) ("'every element of the claimed invention must be identically shown in a single reference.'").

The references of record including Nagata et al. patent, theTews et al. Lautenschlager et al., patent, the Scott publication, nor the Madaras et al. publication, individually or considering the total teachings in combination, do not disclose, nor suggest generating said resonance patterns either as a function of sample

concentration or as a function of excitation frequency for a given sample; and using said generated resonance patterns for real-time identifying chemical and biological materials of the sample.

Anticipation is a question of fact. In re King, 801 F.2d 1324, 231 USPQ 136 (Fed. Cir. 1986). The inquiry as to whether a reference anticipates a claim must focus on what subject matter is encompassed by the claim and what subject matter is described by the reference. As set forth by the court in Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 218 USPQ 781, 789 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026 (1984), it is only necessary for the claims to "'read on' something disclosed in the reference, i.e., all limitations in the claim are found in the reference, or 'fully met' by it." Anticipation under § 102 can be found only when the reference discloses exactly what is claimed; where there are differences between the reference disclosure and the claim, the rejection must be based on § 103 which takes differences into account. Tyler Refrigeration v. Kysor Industrial Corp., 777 F.2d 687, 689, 227 U.S.P.Q. 845 846-47 (Fed. Cir. 1985). It must be shown that the reference contains all of the elements of the claims, and that the elements are arranged in the same way to achieve the same result which is asserted to be an inventive function. Reconsideration of the Nagata et al., Tews et al. patents and the Scott publication and the subject matter of the pending claims and withdrawal of the rejections under 35 U.S.C. §102 and allowance of pending claims 2-12,as amended, is respectfully requested.

Neither the Nagata et al. patent, theTews et al. Lautenschlager et al., patent, the Scott publication, nor the Madaras et al. publication, individually or

considering the total teachings in combination, suggest nor render obvious the subject matter of the claimed invention, as recited by independent claim 2,as amended. Rejections based on § 103 must rest on a factual basis with these facts being interpreted without hindsight reconstruction of the invention from the prior art. The Examiner may not, because of doubt that the invention is patentable, resort to speculation, unfounded assumption or hindsight reconstruction to supply deficiencies in the factual basis for the rejection. See In re Warner, 379 F.2d 1011, 1017, 154 USPQ 173, 178 (CCPA 1967), cert. denied, 389 U.S. 1057 (1968).

Only Applicants teach a dielectric sensing method for detection and classification of chemical and biological materials, as recited by independent claim 2,as amended. Only Applicants teach such a dielectric sensing method that includes the steps of detecting resonance patterns and identifying a shift in resonance frequency and a change of line width before and after introduction of the sample into said resonator; generating said resonance patterns either as a function of sample concentration or as a function of excitation frequency for a given sample; using said identified shift in resonance frequency and change of line width for determining a complex dielectric constant of the sample for the material detection and classification of the sample, and using said generated resonance patterns for real-time identifying chemical and biological materials of the sample as recited by amended independent claim 2.

Thus, independent claim 2, as amended, is patentable.

Each of the dependent claims 3-12 further define the subject matter of

patentable independent claim 2, and each of the dependent claims 3-12 is patentable.

Reconsideration and allowance of each of the pending claims 2-12, as amended, is respectfully requested.

Applicants have reviewed all the art of record, and respectfully submit that the claimed invention is patentable over all the art of record, including the references not relied upon by the Examiner for the rejection of the pending claims.

It is believed that the present application is now in condition for allowance and allowance of each of the pending claims 2-12, as amended, is respectfully requested. Prompt and favorable reconsideration is respectfully requested.

If the Examiner upon considering this amendment should find that a telephone interview would be helpful in expediting allowance of the present application, the Examiner is respectfully urged to call the applicants' attorney at the number listed below.

Respectfully submitted,

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